



## Early regimes of water imbibition in nanoslit silica channels

Oyarzua, Elton; Zambrano, Harvey; Walther, Jens Honore; Mejia, Andres

*Publication date:*  
2014

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*Citation (APA):*

Oyarzua, E., Zambrano, H., Walther, J. H., & Mejia, A. (2014). *Early regimes of water imbibition in nanoslit silica channels*. Abstract from 67th Annual Meeting of the APS Division of Fluid Dynamics, San Francisco, CA, United States.

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Abstract Submitted  
for the DFD14 Meeting of  
The American Physical Society

**Early regimes of water imbibition in nanoslit silica channels<sup>1</sup>**

ELTON OYARZUA, HARVEY ZAMBRANO, Universidad de Concepcion, JENS HONORE WALTHER<sup>2</sup>, Technical University of Denmark, ANDRES MEJIA, Universidad de Concepcion — Capillarity is currently subject to a significant research interest. Attention is mainly paid to the late stage of the imbibition when a developed flow is reached and the Laplace pressure is balanced by the viscosity. Nevertheless, as the miniaturization of devices is reaching the nanoscale a thorough understanding of fluid flow in nanoconfinement is required. In nanofluidics, short timescales and surface characteristics dominate the flows. In this study, molecular simulations are conducted to investigate the early stage of water imbibition in silica nanochannels with heights of 4 to 10 nm. Results indicate that nanoscale imbibition is divided in three regimes. An initial regime with imbibition linearly dependent of time, where the capillary force is mainly balanced by inertia. Thereafter, a period, in which, the balance has contributions from both inertia and viscosity and, subsequently, a final regime, wherein, viscosity dominates the capillary force balance. Velocity profiles confirm the passage from an inviscid flow to a developed Poiseuille flow. The meniscus position as a function of time and air accumulation in front of the advancing meniscus are computed for different air pressures, the results reveal a systematic retarding effect of gas pressurization on the imbibition.

<sup>1</sup>We acknowledge support from Fondecyt project No 11130559

<sup>2</sup>Also at Chair of Computational Science ETH Zurich

Harvey Zambrano  
Universidad de Concepcion

Date submitted: 24 Jun 2014

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